Ch. 4

RF POWER AMPLIFIERS

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Classes B

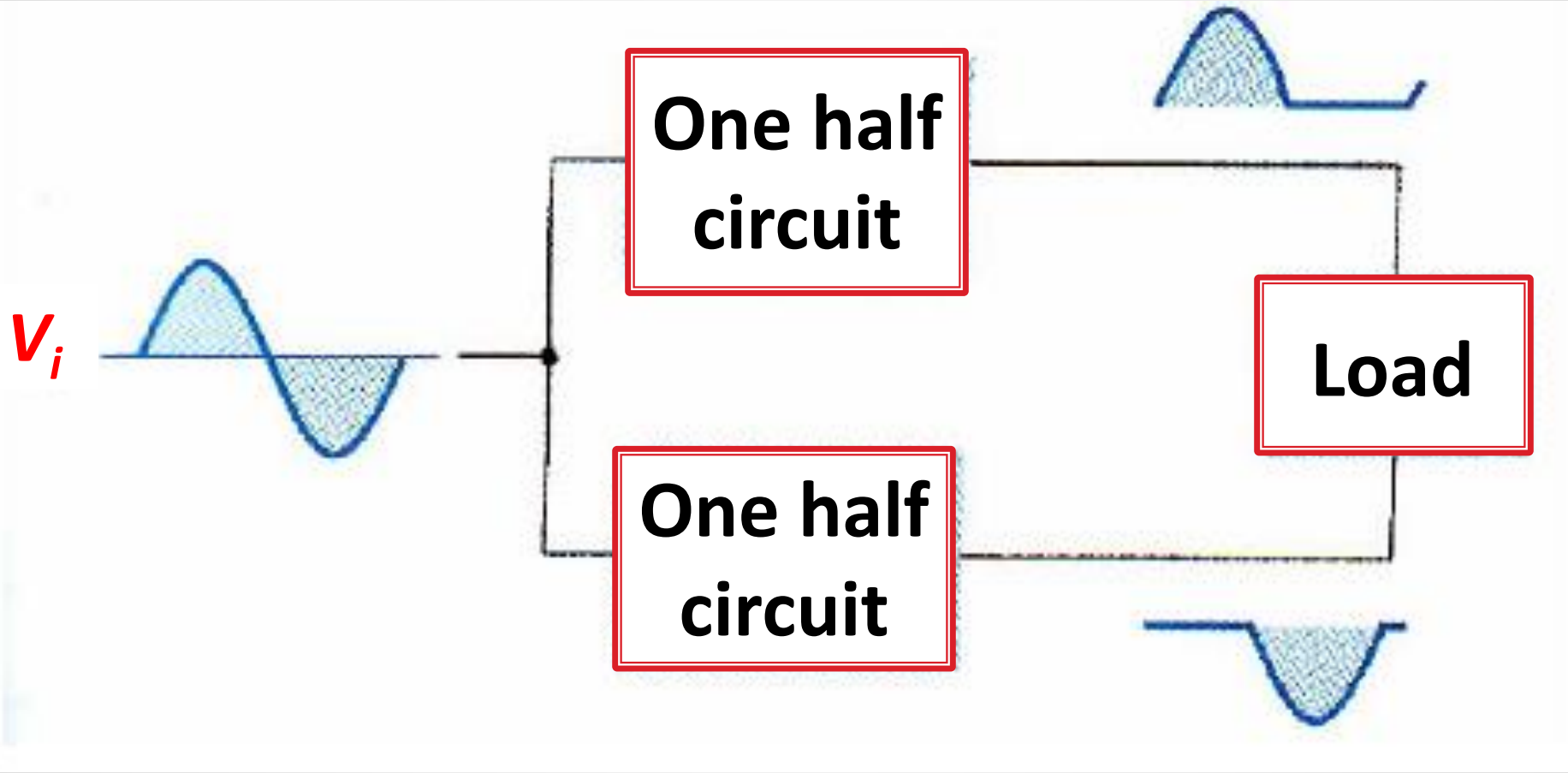
Class B operation is provided when the dc bias leaves the transistor biased just off, the transistor turning on when the ac signal is applied.

This is essentially no bias, and the transistor conducts current for only one-half of the signal cycle.

To obtain output for the full cycle of signal, it is necessary to use two transistors and have each conduct on opposite half-cycles, the combined operation providing a full cycle of output signal.

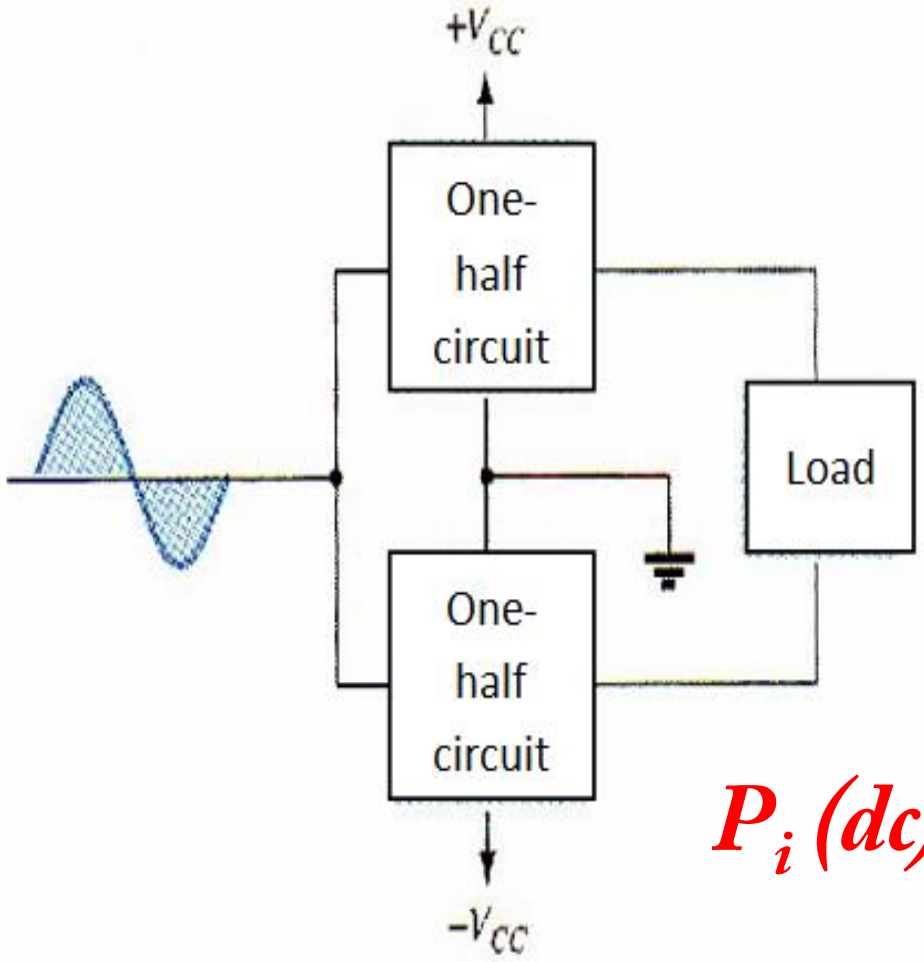
Since one part of the circuit pushes the signal high during one half-cycle and the other part pulls the signal low during the other half-cycle, the circuit is referred to as a push-pull circuit.

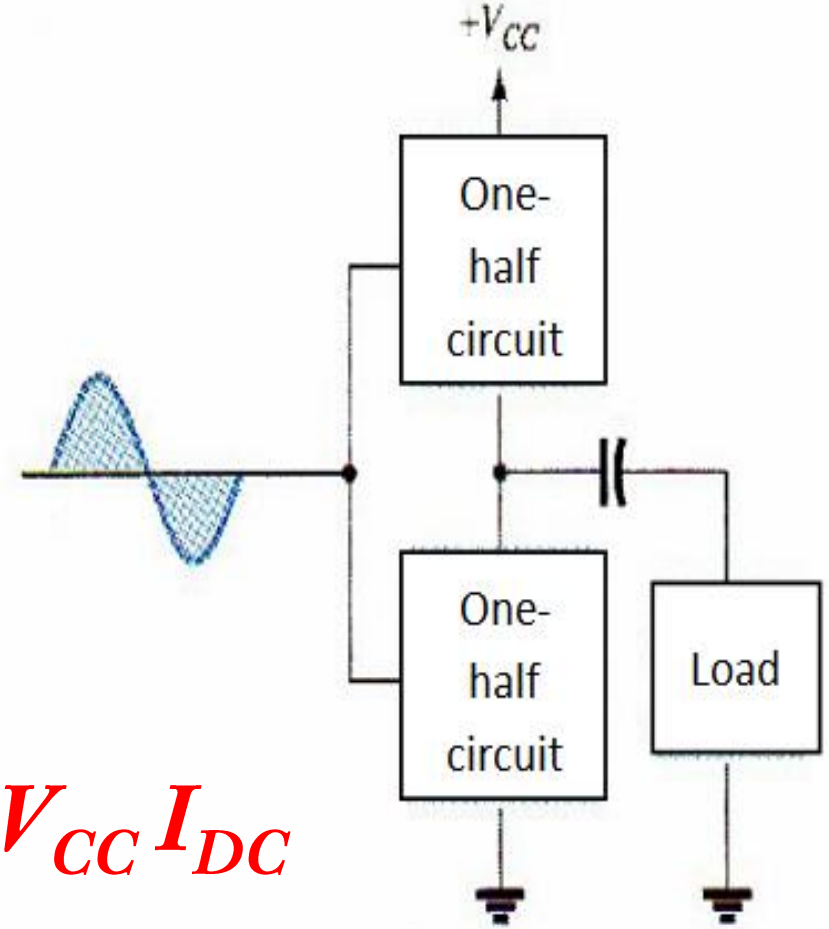
Classes B



class B operation of these transistors provides greater efficiency than was possible using a single transistor in class A operation

Input (DC) Power





$$P_i(dc) = V_{CC} I_{DC}$$

I_{DC} is the average or dc current drawn from the power supplies.

Input (DC) Power

In class B operation, the current drawn from a single power supply has the form of a full-wave rectified signal, while that drawn from two power supplies has the form of a half-wave rectified signal from each supply.

In either case, the value of the average current drawn can be expressed as:

$$I_{DC} = 2/\pi \, . \, I\,(p)$$

$$P_i(dc) = V_{cc}\left(\frac{2}{\pi} I\ (p)\right)$$

Input (DC) Power

$$P_o(ac) = \frac{V_L^2(rms)}{R_L}$$

$$P_o(ac) = \frac{V_L^2(p-p)}{8R_L} = \frac{V_L^2(p)}{2R_L}$$

$$\%\eta = \frac{P_o(ac)}{P_i(dc)}\, x\, 100\%$$

$$\%\eta = \frac{P_o(ac)}{P_i(dc)}\, x\, 100\% = \frac{V_L^2(p)/\,2R_L}{V_{CC}[(2/\pi)\, I(p)]}\, x\, 100\% = \frac{\pi}{4}\frac{V_L(p)}{V_{CC}}\, x\, 100\%$$

Using $I(p) = V_L(p) / R_L$

$$maximum\ efficiency = \frac{\pi}{4}\, x\, 100\% = 78.54\%$$

Power Dissipated by Output Transistors

The power dissipated (as heat) by the output power transistors is the difference between the input power delivered by the supplies and the output power delivered to the load.

$$P_{2Q} = P_i\,(dc) - P_o\,(ac) \qquad (47)$$

where P_{2Q} is the power dissipated by the two output power transistors. The dissipated power handled by each transistor is then

$$P_Q = P_{2Q} / 2 \qquad (48)$$

THANK YOU

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